

J. Raptor Res. 21(3):116-118

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SHORT COMMUNICATIONS

NESTING CHRONOLOGY OF THE GREAT GRAY OWL AT AN ARTIFICIAL NEST SITE IN THE SIERRA NEVADA

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The California Great Gray Owl (*Strix nebulosa*) population is centered in the Yosemite region of the Sierra Nevada (Winter 1980). Efforts were initiated in 1980 to enhance breeding habitat at Ackerson Meadow in the Stanislaus National Forest by providing artificial nests at 1400 m elevation, the lower elevational range for Great Gray Owl breeding in this part of California (Winter 1984). Artificial nests made of wire and sticks were successfully used by Great Gray Owls in Manitoba (Nero et al. 1974). Most nests reported for North America have been in old stick nests made by hawks (Bent 1938, telecon Dec 1986 with Evelyn L. Bull, USDA Forest Service Research Station, La Grande, OR 1987), whereas nests in the Sierra Nevada have been in the tops of broken conifer trees near large meadows (Winter 1980).

In September 1984 ten artificial nest structures were constructed at Ackerson Meadow by topping large conifers to simulate broken-topped snags. Trees with a dbh of 76-137 cm (\bar{x} = 109 cm) were cut 8.5-20 m high (\bar{x} = 12.2 m), and tops were then hollowed into a bowl shape with a drain hole for removal of rain water. All nest construction was performed by a climber using a bar-equipped chainsaw. On 18 April 1985 a female Great Gray Owl was found incubating at one of the artificial sites, an Incense Cedar (*Calocedrus decurrens*) 11 m high with a dbh of 94 cm. The diameter at the top of the tree was 58 cm; the nest bowl was 46 cm across and 18 cm deep. The nest tree was 158 m from the closest meadow and received partial shade briefly during early afternoon.

On 1 May a Canon 512-XL 8-mm movie camera adapted for automatic, time-lapse photography was positioned 37 m from the nest and used to record nesting behavior and chronology (see Temple 1972). Nocturnal photographic equipment was not available. The camera was equipped with a 47.5 mm telephoto lens and was operated by a photoelectric sensor which activated the timing device. Timing intervals were 90, 96, and 105 sec, and the period recorded each day was 14-15 hr. Photo intervals were lengthened as days became longer to ensure seven days coverage with each roll of film. Dates monitored were 1-27 May and 6-19 June. Personal visits were made on 29 and 31 May. Daily temperatures were obtained from U.S. Weather Bureau records taken at Cherry Lake located 13 km distant at the same elevation as Ackerson Meadow.

Behavior of the female owl indicated that the first egg hatched on 14 May. On that date she began repositioning, looking down, and reaching her head down into the bottom of the nest. On this basis we estimated that egg laying began at the Ackerson Meadow nest on or close to 14 April (see Craighead and Craighead 1956; von Haartman et al. 1963-1972). In northern Finland the incubation period at one Great Gray Owl nest studied closely was at least 36 d (Pullainen and Loisa 1977). von Haartman et al. (1963-1972, in Pullainen and Loisa 1977) assumed the incubation period to be about one month. Craighead and Craighead (1956) reported the earliest egg laying date in Wyoming to be 1 April and the earliest hatching date to be 30 April. Little variation in behavior of the female occurred during late incubation (i.e., 1-14 May). In the daytime (ca 14 hr) the female was away from the nest 0.8% of the time, which usually involved one absence of 5-10 min/d in the late afternoon or early evening close to the nest. Feeding visits by the male occurred at night and began at dusk, but none were recorded by the camera. Pullainen and Loisa (1977), based on nine 24 hr periods, reported that the female was absent an average of 3.1 times/d, all <5 min in duration, for a total absence of 0.63% during incubation. Food was brought by the male mainly between 2000 and 0200 H. In Sweden only the male brought prey to the nest during incubation and the number varied from three to five vole-sized items/d (Hoglund and Lansgren 1968).

During early brooding from 15-27 May, the female was absent from the nest an average of 2.0% of the time monitored and the male made feeding visits to the nest during the day. On 22, 24 and 25 May the male was seen at the nest once/d for 1-2 min at 1000, 1945 and 1825 H, respectively. Other feedings by the male could have occurred and been missed by the camera. On the night of 23 and 24 May, the male brought food to the nest at 2040, 2330, 0110, 0235 and 0550 H. In Finland the female was absent 1.0% of the time and the male began bringing food to the nest during the daytime in the first two weeks after hatching (Pullainen and Loisa 1977).

During late brooding from 6-15 June (age of older chick = 23-32 d), the female was absent from the nest an average of 43.8% (range 27-58%/d) of the time recorded (ca 6.6 hr of 15 hr/d). Absences averaged 3.4/d

(range two to four). Time off the nest was spent hunting and roosting as far away as 100 m. The female was observed bringing a Pocket Gopher (*Thomomys bottae*) to the nest on 31 May in the early afternoon. In Finland Pullainen and Loisa (1977) reported that the female stopped warming the young at 14 d old and with young 15–24 d old the female was absent from the nest 13.1% of the time. During 0600–2100 H in Finland, comparable to our study, the female was absent 6.1% and most of that time sat quietly in the vicinity of the nest, occasionally bringing food to the nestlings (Pullainen and Loisa 1977). In Sweden Hoglund and Lansgren (1968) reported that the female began bringing prey to the nest 11 d into the nestling period. Winter (telecon Dec 1986) suggests that while off the nest the female generally roosts and only occasionally hunts.

Hatching date of the second egg was uncertain. Based on the behavior of the female, hatching could have been on 15 or 16 May, but small size of the second young at the end of the nestling period suggested that second hatching might have been several days to a week after the first. Small clutches are usually laid at a rate of one egg/d, but six to 12 d may elapse between later eggs in larger clutches; since incubation begins with the first egg, young in a large brood may differ greatly in size and development (Blair 1962). Broods of more than two have not been recorded in California. Food scarcity and/or delayed hatching may have caused the small size of the younger chick. Hoglund et al. (1968) noted that in a nest of several young it is not unusual for the youngest to develop slowly and to die before reaching fledgling size. Winter (1982, 1984) concluded that irregular breeding in the Sierra Nevada reflects year-to-year abundance of primary prey species.

The first young was observed on 23 May at 9 d old. On 6 June both young were visible, and the older chick at 23 d old was at least twice the size of the younger. From 6–15 June the older chick was quite mobile about the nest, especially during absences of the female. During 13–15 June and when the female was absent the older chick perched much of the time outside (within 1–2 m) of the nest. On 13 June the younger chick was mysteriously found in a weakened condition on the ground below the nest and was returned to the nest a few hours later. During the evening of 15 June or morning of 16 June before dawn, the older nestling left the nest at 32 d old. Visual observations of the nest during the final week when both young were present showed that midday heat caused stress on the female and on the young when the female was absent as evidenced by gular flutter behavior. Hoglund and Lansgren (1968) reported that in Sweden the departure of the young from the nest at 20–29 d old was caused by heat from the sun.

On 16, 17 and 18 June, when only the underdeveloped younger chick remained, the female was absent from the nest 99.8% of the time. On 17 June the chick showed signs of extreme heat stress and a sun shade was erected. On

18 June the chick disappeared from the nest at 1845 H. Ground search on 20 June proved unsuccessful and we assumed the chick was taken from the nest or the ground by a predator. On 17, 20 and 25 June the female and fledgling were observed day-roosting about 65 m from the nest tree.

The amount of time the female was absent from the nest during late brooding seems excessive and was considerably greater than that reported by Pullainen and Loisa (1977) for the same daytime hours. Daytime average maximum temps, based on Cherry Lake records, were: 1–14 May, 20°C (range = 12–26°C); 15–27 May, 23°C (range = 21.5–28°C); 6–15 June, 31°C (range = 28.5–33.2°C); 16–18 June, 34°C (range = 33.2–34.5°C). Behavior of the female may have been affected by heat which would explain absence during late brooding and virtual abandonment of the younger nestling.

On 21 April 1987 a female Great Gray Owl was found using an artificial nest site ca 100 m from the one used in 1985 which was similar except for the presence of more shade canopy. We could not determine if it was the same owl which nested in 1985, and on or about 24 May the nest was abandoned. No sign of young were seen and the cause of abandonment is unknown. Several natural nest sites were also abandoned in 1987 in Yosemite National Park for unknown reasons (telecon with Jon Winter May 1987).

Our observations indicate that artificial nest structures simulating broken-topped snags are accepted by Great Gray Owls. At lower elevations in the Sierra Nevada such structures should be constructed only where shading can be provided. Time-lapse photography of owl nests can yield useful data on nesting chronology and behavior but should include nocturnal recording capability.

ACKNOWLEDGMENTS

We thank Steve Brougher, Kirk Ford, Bill Kiger, Steve Laymon and Jon Winter for providing observations and assistance at the nest site, Mike Webb for photographs and Jared Verner and Jon Winter for their valuable comments on the draft manuscript.

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Received 1 February 1987; Accepted 12 August 1987

J. Raptor Res. 21(3):118-120

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AGONISTIC ENCOUNTERS BETWEEN BALD EAGLES AND OTHER RAPTORS WINTERING IN WESTCENTRAL UTAH

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Each year 200-300 Bald Eagles (*Haliaeetus leucocephalus*) winter in Rush Valley, 70 km southwest of Salt Lake City, Tooele Co., Utah (Edwards 1969). Golden Eagles (*Aquila chrysaetos*), Ferruginous Hawks (*Buteo regalis*), and Red-tailed Hawks (*Buteo jamaicensis*) also winter in the area and may compete with Bald Eagles for food. In January-March 1982, 1983 and 1984 we compiled over 1500 hr of field observations on Bald Eagles wintering in Rush Valley. We noted seven interspecific encounters involving adult Bald Eagles and one of the above raptors. As far as we know, these are the only reported observations of agonistic interactions between Bald Eagles and Golden Eagles or Ferruginous Hawks.

We observed two interspecific encounters between Bald and Golden Eagles near Black-tailed Jackrabbit (*Lepus californicus*) carcasses during 1984. On 17 January K.G. saw an adult Bald and an adult Golden Eagle involved in an aerial confrontation 50 m above the ground. Both birds made several passes at one another but no contact was made, and within two min both had landed on the ground. Three min later the Bald Eagle flew directly at, dove, and struck on the back another adult Golden Eagle perched on the ground 50-100 m away. A struggle ensued in which each bird struck the other repeatedly with open talons. Most attacks were initiated with short hops, but rushes along the ground were also seen. The encounter lasted for about one min and ended when the Golden Eagle flew away. The Bald Eagle returned to the carcass site and

dragged a freshly killed jackrabbit to an area free of vegetation but was supplanted by another adult Bald Eagle before feeding. Later, similar fights took place between several Bald Eagles that attempted to secure the carcass.

On 24 January an adult Golden Eagle was seen feeding on a jackrabbit while one adult Bald and one adult Golden Eagle stood nearby. After 10 min the Bald Eagle supplanted the feeding bird with a short rush to the carcass. Seven min later the second Golden Eagle displaced the Bald Eagle by momentarily landing on its back with closed talons. The Bald Eagle responded by flying and landing about five m from the carcass. A third adult Golden Eagle closer to the feeding site faced the Bald Eagle and lowered its head each time the latter attempted to approach the carcass. Eight min later the Bald Eagle successfully supplanted the feeding eagle by flying to the carcass; all Golden Eagles flew away within five min after the Bald Eagle began to feed.

Overall, interspecific confrontations between eagles at feeding sites were rare. Golden Eagles were seen at only 25% (N = 87) of the carcasses visited by Bald Eagles and were present <22% of the time (N = 239 hr) at feeding sites of marked birds. Based on the incidents of 17 and 24 January, we believe that Bald Eagles may occasionally steal prey from Golden Eagles, which contrasts with the dominant position Golden Eagles appear to have in some Bald Eagle winter roosts (Lish 1973).

Aggressiveness shown by both species of eagles may have